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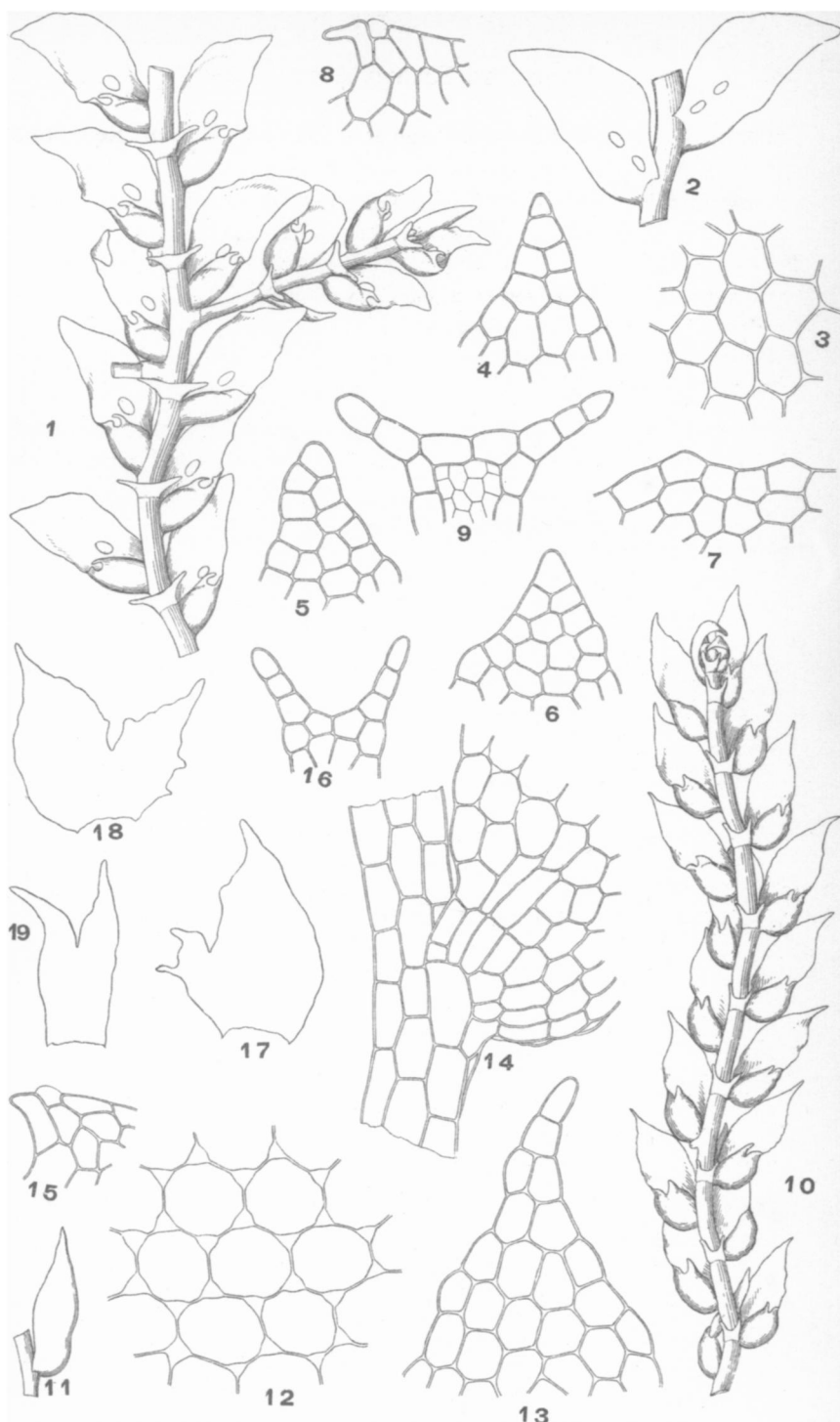
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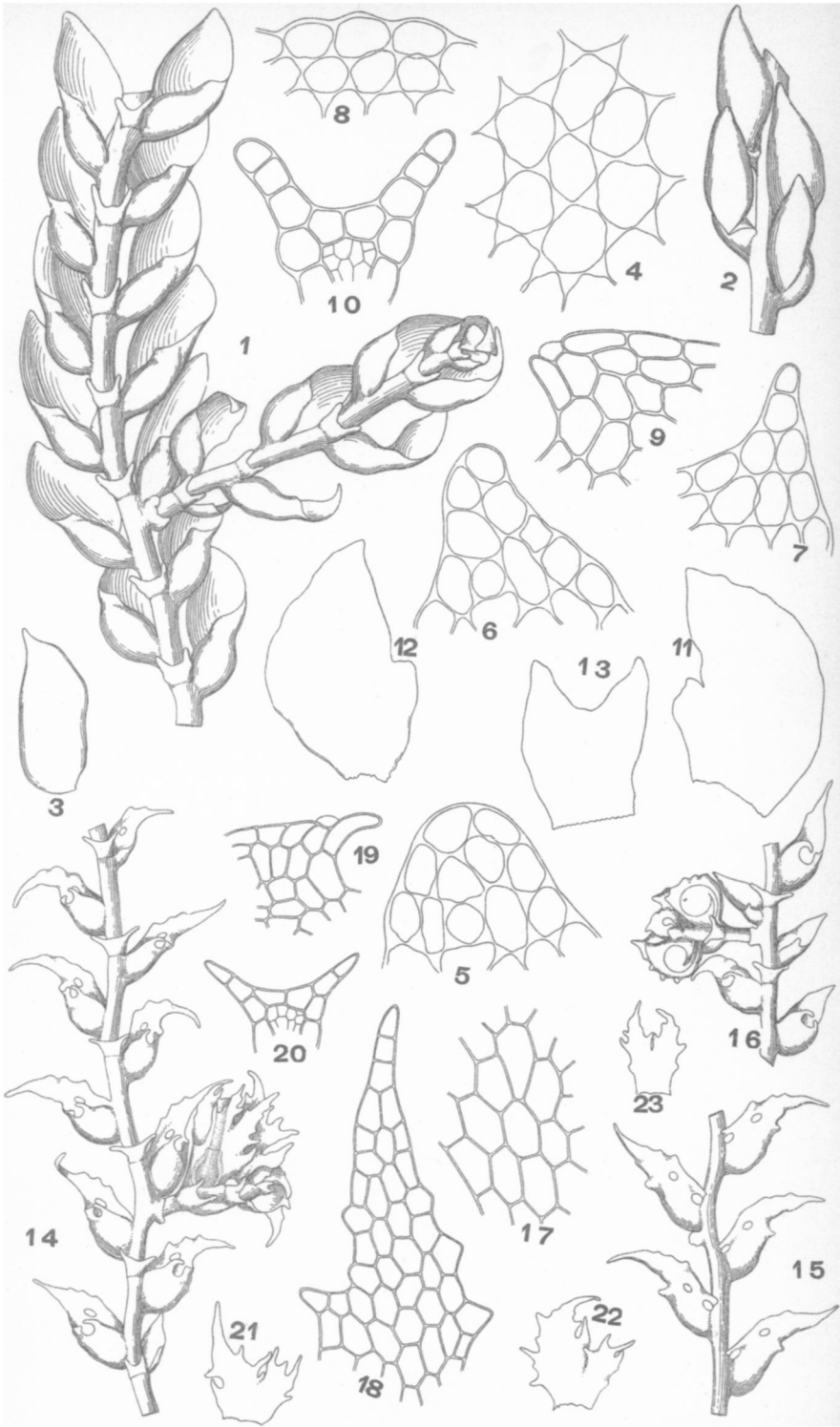
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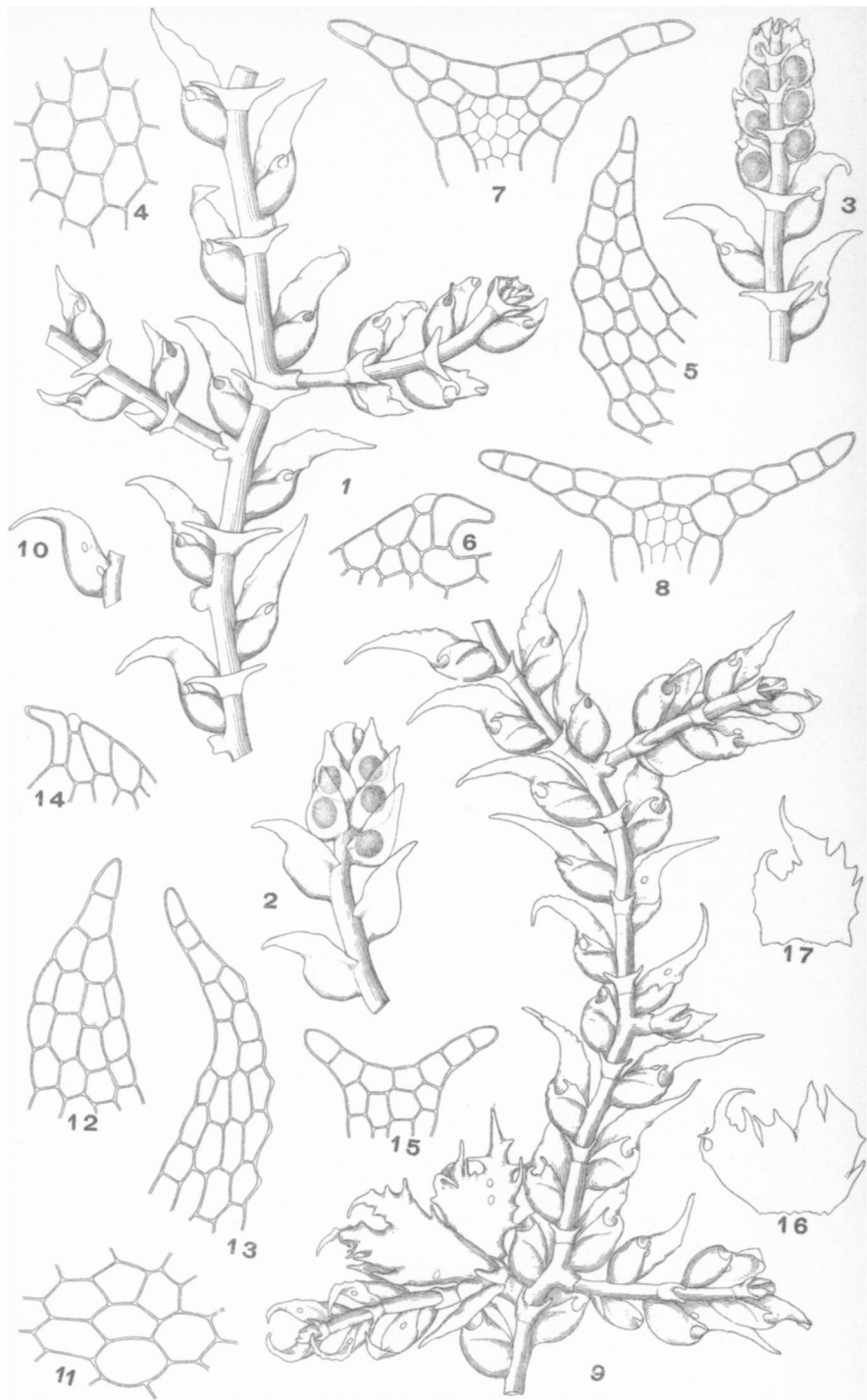
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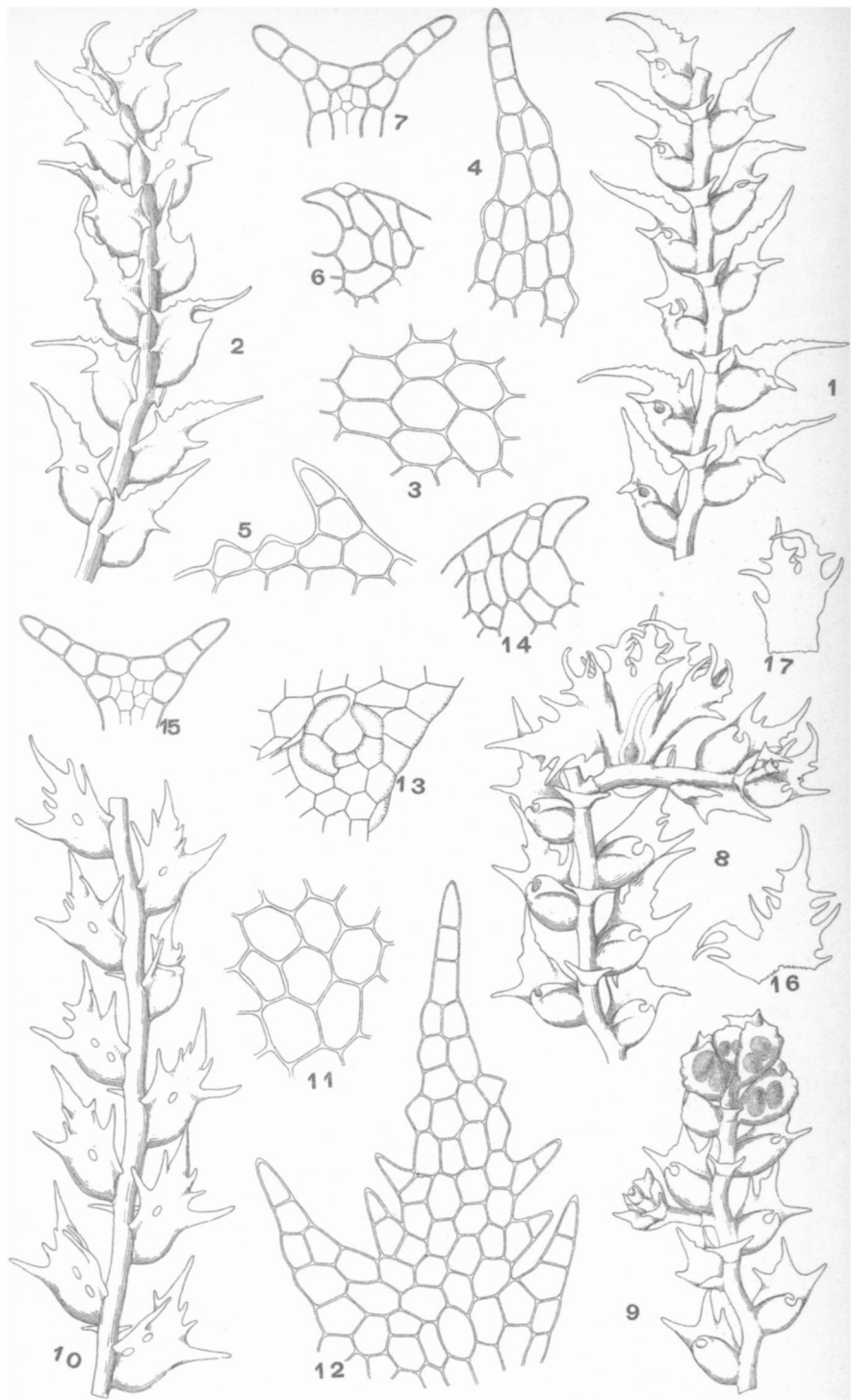
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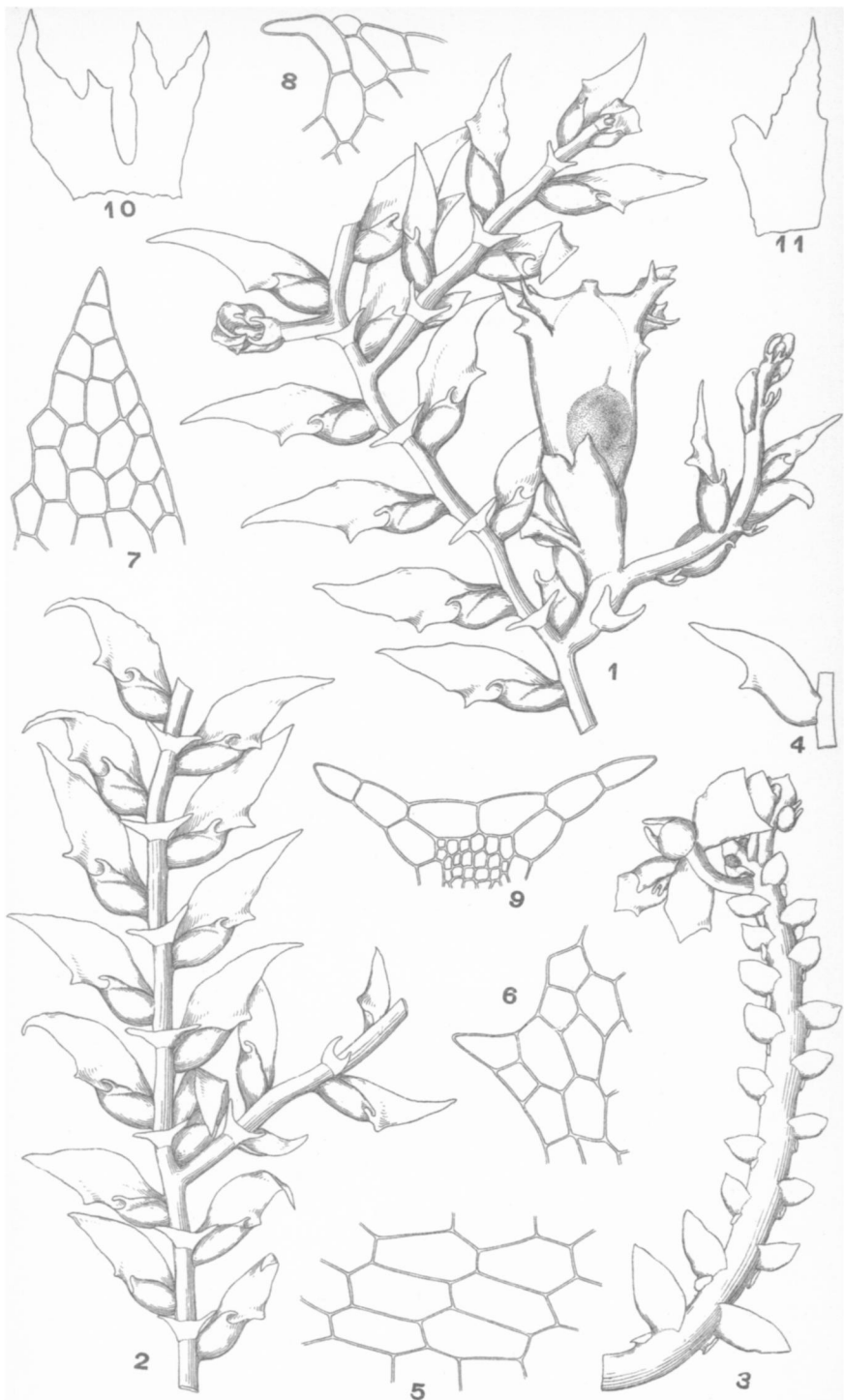


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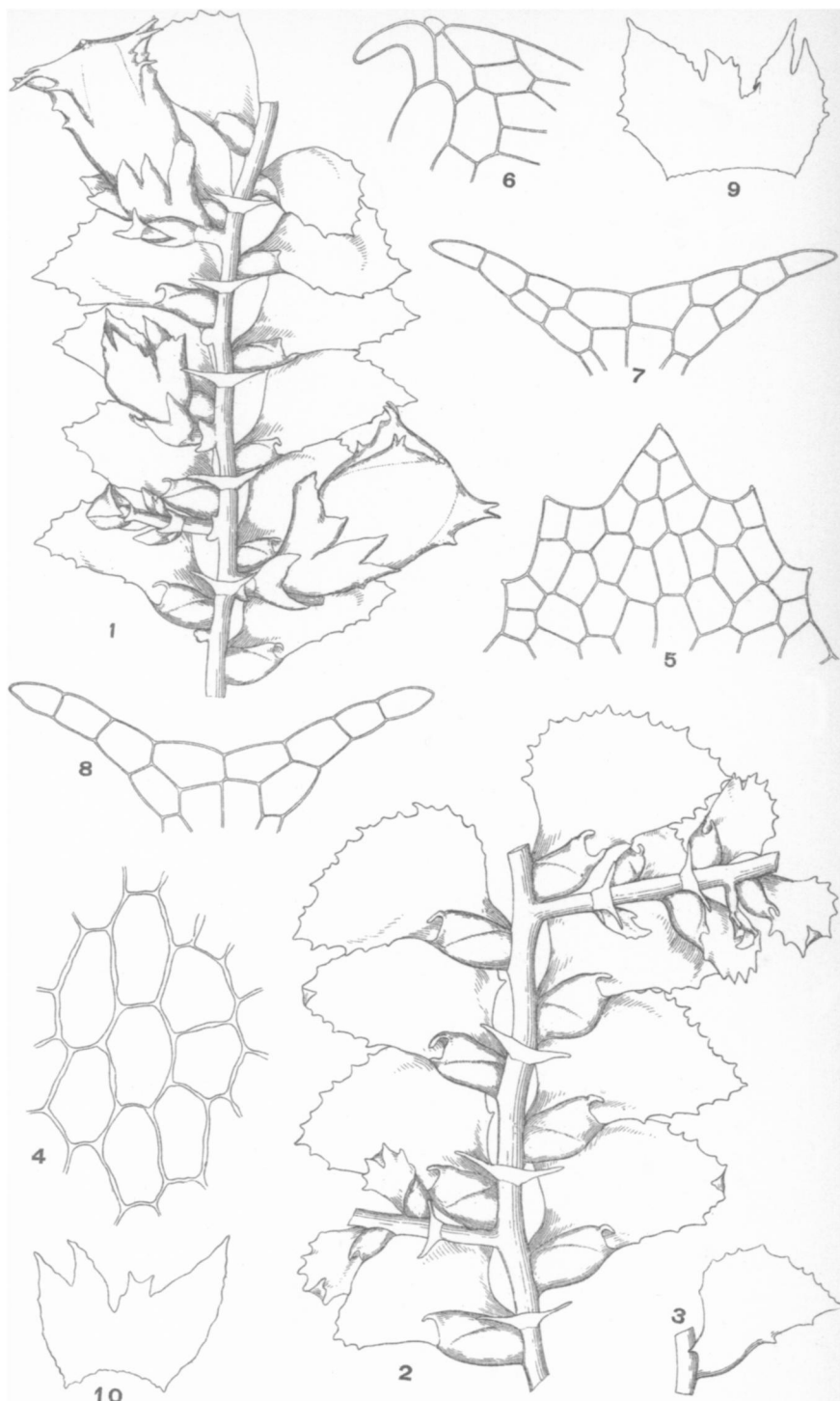
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## Hepaticae of Puerto Rico

### II. DREPANOLEJEUNEA

BY ALEXANDER W. EVANS

(WITH PLATES I-6)

The close relationship which exists between *Drepanolejeunea* and *Leptolejeunea* has already been commented upon in the first paper of this series.\* It may be added that the species of *Drepanolejeunea*, like those of *Leptolejeunea*, are almost exclusively tropical, a single exception being found in *D. hamatifolia* (Hook.) Schiffn., a species originally known from western Europe but since reported from Puerto Rico and also from southern Africa.† Many species of *Drepanolejeunea* grow on living leaves, but others prefer rotten wood or the bark of trees, and *D. hamatifolia* often occurs on rocks. Certain species creep through tufts of mosses or other hepatics from which it is often difficult to disentangle them. It is much more common in fact to find several closely related species growing together on a leaf or a piece of bark than to find a patch composed of a single species.

In the "Expositio Hepaticarum Portoricensium" of Hampe and Gottsche‡ three species of *Lejeunea* are included which are now referred to *Drepanolejeunea*. These are *D. hamatifolia*, to which attention has already been called, *D. inchoata* (Meissn.) Schiffn. and *D. tenuis* (R. Bl. & Nees) Schiffn. They were collected about fifty years ago by Carl Schwanecke in the vicinity of Humacao at the eastern end of the island. Only one of these species, *D. inchoata*, has since been found in Puerto Rico and there is consequently some doubt regarding the determinations of the other two. *D. tenuis*, for example, was first described from Java and although it has been reported from French Guiana§ and also, much more recently, from Costa Rica,|| Spruce questions its oc-

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\* Bull. Torrey Club, 29: 496. 1902.

† Pearson, Christiania Vidensk.-Selsk. Forh. 1886<sup>3</sup>: 5.

‡ Linnaea, 25: 337-358. 1852.

§ G. L. & N. Syn. Hep. 390. 1845.

|| Stephani, Bull. Soc. Roy. Bot. de Belgique, 31: 179. 1892.



currence in America.\* With regard to *D. hamatifolia* it should be stated that no American stations for the species have recently been cited with any degree of certainty and that the American specimens quoted in the Synopsis Hepaticarum † undoubtedly belong elsewhere. Schiffner ‡ reports, nevertheless, that specimens of a *Drepanolejeunea* identical with this species or at any rate very close to it occur in Schwanecke's collection mixed with *Harpalejeunea patentissima*, and it is possible that these were the plants determined by Hampe and Gottsche. A fourth species, *D. subulata*, has recently been described by Stephani, likewise from Schwanecke's collection. It appears probable that this species is based on the "*Lejeunia tenuis*" of Hampe and Gottsche's list, although this is not definitely stated by its author.

The collections of Puerto Rico Hepaticae made by A. A. Heller and by the writer include ten species of *Drepanolejeunea*, all found in the Luquillo Mountains. Of these ten species *D. inchoata* and *D. subulata* have already been recorded from the island, four of the other species, *D. Araucariae*, *D. bidens*, *D. crucianella* and *D. infundibulata*, are known from other parts of tropical America, while the remaining four are apparently undescribed. Of the two recorded species *D. inchoata* has a wide distribution in South America and the West Indies, while *D. subulata* is known from Puerto Rico only. It will be seen therefore that fifty per cent. of the species known with certainty from the island seem to be endemic, a ratio which will doubtless be reduced by careful exploration of the neighboring islands.

In all the Puerto Rico species of *Drepanolejeunea* the lobule is constructed on essentially the same plan as in *Leptolejeunea stenophylla* and *L. hamulata*. This type of lobule is characterized by a peculiar curved cell or tooth at the apex, which assists materially in forming the opening into the water-sac of the leaf. At the base of the tooth on the side toward the axis there is present a slight depression or notch in which a unicellular thin-walled and hyaline papilla is situated. The terminal cell curves outward, coming into contact with the postical surface of the lobe and some-

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\* Hep. Amaz. et And. 192. 1884.

† P. 344. See also Stephani, Hedwigia, 29 : 71. 1890.

‡ Engler's Bot. Jahrb. 23 : 591. 1897.

times extending as far as the end of the keel, which in many cases curves forward and meets it. The extreme development of this type of lobule is seen especially well in *D. crucianella* (pl. 4, f. 13) but is also found in *D. bidens* and in other species. The lower edge of the lobule is here adnate in its outer part to the postical surface of the lobe, giving rise in this way to a short and rudimentary wing which is scarcely a cell broad and only one or two cells long. The adnate portion of the lobule is itself only two or three cells long and a single cell wide ; its terminal cell, although attached at its base to the lobe, projects at its apex as a distinct tooth which meets the curved tooth at the apex of the lobule. These two teeth, together with the sinus of the lobule, form a circular opening into the water-sac. We find among the Puerto Rico *Drepanolejeuneae* all gradations between this extreme development of the lobule and that seen for example in *D. subulata*, where the terminal cell is only slightly curved and does not reach the end of the keel. We must bear in mind, however, that the development of the lobule is very dependent upon external conditions and that we frequently find specimens in which the typical lobular characters of the species are not clearly indicated.

Although ocelli are not usually found in *Drepanolejeunea*, no fewer than six of the Puerto Rico species exhibit them. They are never conspicuous and their number (in the vegetative leaves at least) never exceeds two. Even in species in which they are normally present, many of the leaves, especially those which are poorly developed, fail to show them. The ocelli in most cases are no larger than the neighboring cells and usually retain their angular form even when their contents become lifeless. They are distinguished by the granular or fatty bodies which they contain and do not usually become hyaline and empty as in many other *Lejeuneae*. Sometimes the addition of potash solution brings them out more clearly. With regard to the uses of these ocelli practically nothing is known, although it is probable that they sometimes take part in the formation of the water-sac as in *Leptolejeunea exocellata*. It is not at all likely, however, that they are ever the empty mother-cells of disc-shaped gemmae as in certain species of *Cololejeunea* and probably of other genera. *Drepanolejeunea* in fact seems never to develop gemmae of this type but reproduces itself

vegetatively by means of leafy propagula which are similar to those of *Leptolejeunea*.

In the present paper only those species are described of which specimens from Puerto Rico have been personally examined, but a few critical notes are interpolated regarding *D. hamatifolia* and *D. tenuis*. The writer would express his thanks to Mr. Matthew B. Slater, of Molton, Yorkshire, who has kindly loaned him for study the various species of *Drepanolejeunea* described by Spruce, and also to Herr Stephani, of Leipzig, who has confirmed several determinations.

***Drepanolejeunea biocellata* sp. nov.**

Yellowish- or brownish-green, growing in thin irregular patches; stems 0.04 mm. in diameter, closely adherent to substratum, irregularly pinnate, the branches widely spreading: leaves distant to slightly imbricated, the lobe suberect to obliquely spreading, more or less convex, often deflexed at the apex, ovate, distinctly narrowed toward the base, 0.35 mm. long, 0.2 mm. wide, attached by a short oblique line of insertion, straight or slightly falcate, margin entire or more or less denticulate from projecting cells, sometimes with an indistinct angular tooth near end of keel, antical margin arched, postical margin straight or nearly so, apex obtuse to acute, usually tipped with a single cell, rarely with two cells in a row; lobule ovate, 0.14 mm. long, 0.09 mm. wide, inflated throughout or plane at apex and along part of free margin, keel arched, roughened near end from projecting cells, free margin sometimes plane and appressed to lobe but usually involute to beyond apex then passing by a lunulate sinus to end of keel, apical tooth strongly curved; cells of lobe plane or slightly convex, averaging  $15\mu$  at the margin and  $18 \times 15\mu$  in the median and basal regions, walls more or less thickened, trigones and intermediate thickenings sometimes distinct, sometimes confluent and indistinct; ocelli commonly two, one in lower half of lobe, the other (sometimes obsolete) at or near the base, a little larger than the surrounding cells, measuring  $27 \times 18\mu$ : underleaves distant, basal portion rectangular or trapezoidal, 0.05 mm. long, 0.045 mm. wide at base, marginal cells six, scarcely bulging, divisions widely spreading, consisting of two or three cells in a single row, with a spread of 0.1 mm.: inflorescence dioicous: ♀ inflorescence on a short branch, innovating on one side with a short and simple innovation; bracts obliquely spreading, complicate, unequally bifid, the lobe ovate-lanceolate, 0.35 mm. long, 0.15 mm. wide, acute, margin entire or irregularly and vaguely crenulate, lobule oblong, 0.2 mm. long, 0.09 mm. wide, truncate to bluntly pointed, entire;

bracteole free or nearly so, oblong, 0.3 mm. long, 0.15 mm. wide, bifid about one half with subulate acute divisions, margin entire; perianth obovoid, projecting somewhat beyond bracts, 0.6 mm. long, 0.35 mm. wide, narrowed toward base, truncate above and with a short beak, terete in lower part, sharply five-keeled above, the antical keel lower than the others and sometimes obsolete, keels rounded above or projecting as short horizontal obtuse or acute horns, more or less roughened or dentate at their extremities from projecting cells: ♂ inflorescence terminal; bracts in several to many pairs, inflated, shortly bifid, the lobe obtuse and the lobule rounded, keel strongly arched, bordered in the outer part by a row of bulging hyaline cells, bracteoles limited to base of spike, rudimentary; antheridia in pairs: mature sporophyte unknown (*pl.* 1, *f.* 1-9).

On living leaves and on a log. El Yunque, *Evans* (23 *p.p.*, 89 *p.p.*).

The original specimens of this species from which the drawings were made were collected in 1900 on living leaves and show no signs of reproductive organs with the exception of propagula. They may be looked upon as the type of the species because in them the foliar characters are better developed than in the fertile material with perianths collected in 1902 on a log. In all of the specimens examined branches with rudimentary leaves are frequent, and many of these microphyllous branches, but by no means all of them, bear leafy propagula similar to those described for *Leptolejeunea stenophylla* and *L. hamulata*. The leaf-cells of *D. biocellata* are very variable with respect to the local thickenings of their walls. In some cases the cells have fairly thin walls with small trigones, in other cases the walls show conspicuous trigones and intermediate thickenings, while in still other cases the thickenings are more or less confluent and give the walls the appearance of being irregularly thickened. It is sometimes possible to find these various conditions on a single plant.

#### DREPANOLEJEUNEA SUBULATA Steph.

? *Lejeunea tenuis* Hampe & Gottsche, *Linnaea*, **25**: 356. 1852.  
Not *Lejeunea tenuis* (R. Bl. & N.) Nees.

*Drepanolejeunea subulata* Steph. *Hedwigia*, **35**: 83. 1896.

Pale yellowish-green, growing in loose thin mats or creeping among other prostrate hepatics: stems 0.05 mm. in diameter, pros-

trate, sparingly and irregularly pinnate, the branches obliquely or widely spreading: leaves distant to subimbricated, the lobe erect and subparallel with the axis or slightly spreading, plane or somewhat convex, oblong-lanceolate, 0.4 mm. long, 0.15 mm. wide, narrowed toward the base and attached by a short, slightly oblique line of insertion, margin irregularly crenulate from projecting cells, antical margin slightly curved, apex acute to abruptly acuminate, tipped with a single cell or more commonly with two or three cells in a single row, postical margin curved at about the middle of the leaf, usually forming an obtuse angle with keel; lobule ovate, strongly inflated (except in apical region), 0.15 mm. long, 0.1 mm. wide, keel strongly arched, more or less crenulate at least in outer part from projecting cells, free margin usually involute as far as apex, almost straight when explanate, passing beyond apex by a rounded to obtuse sinus to end of keel, apex acute, tipped with a single slightly curved cell; cells of lobe somewhat convex, thin-walled but with large trigones projecting slightly into cell-cavities, intermediate thickenings rare, cells averaging  $23 \times 16 \mu$  at the edge of the leaf and  $23 \mu$  in the middle; base of lobe showing a distinct group of four oblong cells, each about  $30 \mu$  long and  $9 \mu$  wide; ocelli none; cells of lobule with wavy outlines and no trigones, averaging  $14 \times 17 \mu$ : underleaves distant, basal portion quadrate, scarcely narrowed at line of attachment, 0.05 mm. long, marginal cells six, not bulging, divisions erect-spreading, consisting usually of three cells in a row, rarely two cells wide at base, with a spread of 0.06 mm.: inflorescence dioicous: ♀ inflorescence borne on a short branch, innovating on one side with a simple and sterile innovation; bracts obliquely spreading, scarcely complicate, unequally bifid, the lobe ovate, acute to acuminate, 0.4 mm. long, 0.2 mm. wide, margin subentire to irregularly and sparsely dentate or spinulose, lobule ovate, 0.3 mm. long, 0.15 mm. wide, acuminate to blunt at the apex, margin as in lobes; bracteole free or slightly connate at the base, oblong to subrotund, 0.35 mm. long, 0.15 mm. wide at base, bifid one third to one half with acute to acuminate divisions and acute sinus, margin as in bracts but usually less toothed; perianth somewhat exserted, obovoid, 0.7 mm. long, 0.35 mm. wide, narrowed at the base, rounded to truncate at the apex and with a short beak, terete below, sharply five-keeled above, the keels rounded in the upper part and slightly roughened from projecting cells, not projecting as horns: ♂ inflorescence terminal; bracts in a few pairs, large, rotund-galeate, compressed, truncate above, and scarcely bifid, with a row of hyaline projecting cells along keel (*pl.* 1, *f.* 10-19).

On bark of trees, mixed with other hepatics; north slope of the Luquillo Mountains, *Heller* (4712 *p.p.*, 4737 *p.p.*); El Yunque, *Evans* (53 *p.p.*). First collected by *Schwanecke*.

*Drepanolejeunea subulata* is closely allied to *D. tenuis* and also to *Lejeunea* (*Drepano-Lcj.*) *anoplantha* Spruce, a species first collected by its author in South America but afterwards found by Elliott on Dominica and by Britton and Cowell on St. Kitts. These three species agree in their general appearance and in the possession of a perianth without horns, a most unusual character for the genus. *L. anoplantha* resembles *D. subulata* further in the shape of its underleaves and in the presence of four elongated cells at the base of its leaf-lobes. It differs from the Puerto Rico species in its broader lobes, measuring nine to twelve cells across instead of seven to nine cells, in its smaller leaf-cells, averaging  $17\mu$  in the middle of the lobe, in the more obscure thickenings of their walls, and in its blunter leaf-apices, each tipped usually with a single cell.

Through the kindness of Dr. G. Lindau, of Berlin, the writer has had the privilege of examining specimens of *D. tenuis* collected by Teysmann in Java and determined by Gottsche. In these specimens the leaves are abruptly dilated above the base and then gradually narrowed to the apex, which commonly ends in a single row of three or four cells. This brings the broadest part of the lobe above the middle rather than at the middle as in *D. subulata*. In the Javan species also the apex of the lobe frequently points outward although this condition is not unknown in *D. subulata*. Perhaps the most striking difference between the two species is found in the distinct teeth on the antical margin of the lobe in *D. tenuis*. These teeth are commonly three to five in number, each consisting of a single cell or of two or three superimposed cells. On slender branches the teeth are sometimes poorly developed and sometimes more strongly developed than on robust axes. The perichaetial bracts and bracteoles of *D. tenuis* finally are strongly spinose-dentate.

***Drepanolejeunea crassiretis* sp. nov.**

Yellowish-green, varying to brownish, growing in thin patches: stems 0.05 mm. in diameter, prostrate, irregularly pinnate, the

branches obliquely or widely spreading : leaves more or less imbricated, the lobe erect and subparallel with the axis or slightly spreading at the base with the apex turned forward, strongly convex, oblong-ovate to ovate-lanceolate, 0.3 mm. long, 0.17 mm. wide, somewhat narrowed toward the base and attached by a short slightly oblique line of insertion, margin subentire or indistinctly crenulate or denticulate from projecting cells, antical margin arched, postical margin more or less involute beyond keel, in explanate leaves forming a continuous line with keel, apex varying from rounded to acute, on slender leaves occasionally tipped with two superimposed cells ; lobule strongly inflated throughout, ovate, 0.17 mm. long, 0.09 mm. wide, keel strongly arched, slightly roughened in outer part from projecting cells, free margin involute to beyond apex, then passing by a lunulate sinus to end of keel, apical tooth slightly curved (not clearly visible without dissection) ; cells of lobe convex, averaging  $19\mu$  in diameter, with large and conspicuous trigones and occasional intermediate thickenings separated by small pits, convex wall also thickened, cell-cavities varying from rounded to distinctly stellate, base of lobe showing an indistinct group of elongated cells as in *D. subulata* ; ocelli none ; cells of lobule thickened but without distinct trigones : underleaves distant, basal portion trapezoidal, 0.05 mm. long, 0.04 mm. wide at the base, marginal cells six, the middle one on each side more or less bulging but less distinctly so than in *Leptolejeunea exocellata*, divisions widely spreading, each consisting of two or three cells in a single row, with a spread of 0.07 mm. : cells of underleaf with distinctly thickened walls : inflorescence dioicous : ♀ inflorescence on a short branch, innovating on one side with a simple and sterile innovation ; bracts obliquely spreading, complicate, shortly and unequally bifid, the lobe ovate, falcate, 0.5 mm. long, 0.35 mm. wide, obtuse to acute, entire or irregularly repand and denticulate, lobule oblong, 0.25 mm. long, 0.08 mm. wide, truncate, scarcely separated from lobe ; bracteole free or nearly so, oblong-obovate, 0.35 mm. long, 0.25 mm. wide, bifid about one third with a broad sinus and triangular acute divisions : perianth and ♂ inflorescence unknown (*pl. 2, f. 1-13*).

On a log. El Yunque, *Evans* (89 *p.p.*).

The nearest ally of this new species is apparently *D. subulata*. The two plants resemble each other in their convex leaf-lobes which are erect or approximately so, in the group of elongated cells at the base of the lobe, and in the slightly curved terminal tooth of the lobule. *D. crassiretis* differs from *D. subulata* in its blunter leaves, in its smaller leaf-cells which have thickened

convex walls and more conspicuous trigones, in its firmer underleaves with thicker cell-walls and in its less sharply pointed bracts with blunt lobules. Propagula have not as yet been observed in either species.

The type-specimens of *D. crassiretis* grow mixed with *D. biocellata* and the two species have certain characters in common, such as the thickened cell-walls and the blunt leaf-lobes. There is, however, little difficulty in distinguishing them, on account of the ocellate and usually spreading lobes of *D. biocellata*, the less conspicuous local thickenings in its cells, the more strongly curved apical teeth of its lobules, its narrower perichaetial bracts and narrower and more deeply bifid bracteoles.

DREPANOLEJEUNEA ARAUCARIAE Steph.

*Drepanolejeunea Araucariae* Steph. Hedwigia, **35**: 80. 1896.

Bright green varying to brownish green, growing in thin irregular patches often in company with other Lejeuneae: stems 0.025 mm. in diameter, prostrate, sparingly and irregularly pinnate, the branches widely spreading: leaves distant, the lobe obliquely spreading in the lower part, widely spreading above, plane or slightly concave, falcate-lanceolate, 0.25 mm. long, 0.09 mm. wide, scarcely narrowed at the base and attached by an almost longitudinal line of insertion, margin denticulate, the teeth about three on each side, projecting away from the substratum, each tooth usually a projection from a single cell, the tooth near keel often larger than the others and composed of from one to three cells, apex attenuate ending in two or three cells in a row; lobule strongly inflated, broadly ovate, 0.1 mm. long, 0.07 mm. wide, keel strongly arched, distinctly roughened in outer part from projecting cells, free margin slightly curved, plane and appressed to lobe, passing beyond apex by a lunulate sinus to end of keel, apical tooth more or less curved; cells of lobe plane or nearly so, averaging  $14 \times 9 \mu$ , thin-walled; ocelli commonly two, one at the very base of the lobe measuring  $18 \times 14 \mu$ , the other close to the apex of the lobule: underleaves distant, basal portion subquadrate, 0.03 mm. long, marginal cells six, divisions obliquely to widely spreading (up to 0.08 mm.), each consisting of two or three cells in a row: inflorescence dioicous: ♀ inflorescence usually on a short branch, more rarely on an elongated branch, innovating on one side with a simple and sterile innovation; bracts erect-spreading, more or less complicate, unequally bifid, the lobe ovate to ovate-lanceolate, attenuate, coarsely and irregularly lacinate



or spinose-dentate, 0.25 mm. long, 0.1 mm. wide, lobule irregular in shape, 0.15 mm. long, 0.07 mm. wide, lacinate; bracteole more or less connate on one side, ovate, 0.2 mm. long, 0.15 mm. wide, bifid about one half with attenuate divisions, margin irregularly spinose-dentate; perianth oblong, five-keeled, keels slightly spinose at the apex, postical keels long and narrowly decurrent, parallel, beak tubular, long for the size of the plant: ♂ inflorescence on a short branch; bracts in one or two pairs, imbricated, strongly inflated, the lobe orbicular, abruptly acute at the apex, lobule subacute, keel roughened in the outer part: antheridia borne singly (*pl. 2, f. 14-23*).

On living leaves. El Yunque, *Evans* (36 *p.p.*, 197). Originally collected in Brazil by *Ule*.

*D. Araucariae* is related more or less closely to the four following species under which its differential characters will be noted. It may be stated here, however, that it differs from all of them in its smaller size and in its smaller leaf-cells. It is in fact the smallest and most delicate of all known *Drepanolejeunea* from Puerto Rico. Its propagula offer little that is distinctive. The rudimentary leaves behind which they arise are sometimes borne on specialized axes and are sometimes scattered among normal leaves. The description of the perianth is taken from Stephani.

#### ***Drepanolejeunea dissitifolia* sp. nov.**

Brownish-green, growing in thin irregular patches: stems 0.04 mm. in diameter, prostrate, irregularly pinnate, the branches widely spreading: leaves distant, the lobe obliquely spreading in the lower part, widely spreading above, somewhat convex, falcate-lanceolate, 0.3 mm. long, 0.09 mm. wide, slightly narrowed at the base and attached by an almost longitudinal line of insertion, margin entire or slightly crenulate or denticulate from projecting cells, apex acute to short-acuminate, ending in one cell or in two superimposed cells; lobules strongly inflated, ovate, 0.1 mm. long, 0.07 mm. wide, keel strongly arched, roughened in outer part from projecting cells, free margin slightly curved, involute near base, passing beyond apex by a lunulate sinus to end of keel, apical tooth strongly curved; leaf-cells plane or slightly convex, thin-walled, averaging  $16 \times 12 \mu$ ; ocelli none: underleaves distant, basal portion quadrate to trapezoidal, 0.045 mm. long, marginal cells usually six to eight, rarely as many as ten, divisions widely spreading, sometimes at an angle of  $180^\circ$ , having a spread of 0.15 mm., each three or four cells long and two cells wide at base:

inflorescence dioicous : ♀ inflorescence unknown : ♂ inflorescence terminal on a short or somewhat elongated branch ; bracts in one to four pairs, closely imbricated and strongly inflated, the lobe obliquely spreading, acute, lobule acute, tipped with a small straight apical tooth separated from the end of the keel by a shallow and subacute sinus : antheridia borne singly (*pl.* 3, *f.* 1-8).

On living leaves. El Yunque, *Evans* (23 *p.p.*).

The underleaves of *D. dissitifolia* are more complex than in any of the other Puerto Rico species and form one of its most striking peculiarities. They show their complexity in the large number of cells of which they are composed, the widely spreading divisions and the marginal portion of the base both showing more than the usual number. These complex underleaves to be sure are not invariably developed, those on slender axes often showing a smaller number of cells than those on robust axes.

*D. dissitifolia* is only a trifle larger than *D. Araucariae* which it much resembles in habit. The latter species differs in its distinctly denticulate leaves, in its ocelli, and in the abruptly pointed lobes of its perigonal bracts. *D. dissitifolia* also resembles to a certain extent *D. biocellata* with which the type-specimens are badly mixed. *D. biocellata*, however, is a more robust plant with broader and blunter ocellate leaves and differs further in the thickened walls of its leaf-cells and in its diandrous perigonal bracts.

The propagula of *D. dissitifolia* are borne on branches which are scarcely modified and are frequent both on male and on sterile individuals. In several cases a propagulum which had become established developed a few normal leaves and then passed directly into a male inflorescence without branching. The first leaves and underleaves of the propagula are less specialized than in *Lepto-lejeunea*, the disc on the first underleaf being small and the second leaf showing a well-developed lobule. In the first few leaves, however, the lobe remains short, extending but slightly beyond the lobule and its postical margin frequently bears from one to three sharp teeth.

#### ***Drepanolejeunea bidens* (Steph.)**

*Lejeunea* (*Drepano-Lejeunea*) *bidens* Steph. Hedwigia, 29 : 71. 1890.

Yellowish-green, growing in thin and loose patches : stems 0.035 mm. in diameter, prostrate, irregularly pinnate, the branches

widely spreading: leaves distant to subimbricated, the lobe sub-erect or obliquely spreading in the lower part, widely spreading above, convex, falcate-lanceolate, 0.35 mm. long, 0.08 mm. wide, somewhat narrowed toward the base and attached by an almost longitudinal line of insertion, margin subentire or slightly crenulate or denticulate from projecting cells, rarely with a larger blunt tooth near end of keel, apex long-acuminate, ending in a row of two or three cells; lobule strongly inflated at base and along keel, broadly ovate, 0.15 mm. long, 0.1 mm. wide, keel strongly arched, slightly roughened in outer part from projecting cells, free margin plane and appressed to lobe, passing beyond apex by a lunulate sinus to end of keel, apical tooth strongly curved; cells of lobe somewhat convex, their walls slightly but uniformly thickened, averaging  $19 \times 14 \mu$ ; ocelli commonly two, one at the base of the lobe, the other at about the middle, indistinct: underleaves distant, basal portion quadrate or rectangular, 0.03 mm. long, marginal cells six, divisions obliquely to widely spreading (up to 0.07 mm.), each consisting of two or three cells in a single row, rarely two cells wide at base: inflorescence dioicous: ♀ inflorescence borne on a very short branch innovating on one side with a simple and sterile innovation; bracts obliquely spreading, unequally bifid, the lobe ovate, 0.35 mm. long, 0.15 mm. wide, long-acuminate, the margin coarsely and irregularly dentate or spinulose-ciliate, usually with from four to seven teeth, lobule irregular in shape, 0.25 mm. long, 0.08 mm. wide, acute to acuminate, margin as in lobe, but usually with fewer teeth (mostly one to five); bracteole connate on one side, ovate, 0.3 mm. long, 0.15 mm. wide, bifid about one third with erect, subacuminate lobes and narrow sinus, margin as in bracts, usually with from five to twelve teeth in all: perianth broadly obovoid, 0.4 mm. long, 0.3 mm. wide, gradually narrowed toward the base, truncate above and with a short beak, terete below, sharply five-keeled in upper part, the keels projecting outward as subacute, slightly dentate horns; ♂ inflorescence unknown (*pl.* 3, *f.* 9-17).

On rotten wood. North slope of the Luquillo Mountains, Heller (1139). El Yunque, Evans (4, 196).

The type-specimens of *D. bidens* are in the Lindenberg herbarium at Vienna. They were preserved there under the name "*Lejeunea hamatifolia*" until Stephani proved their distinctness. Nothing definite seems to be known as to where they were collected, their label reading simply (according to Stephani) "in cortice peruv.," but it is probable that they came from tropical America. The species does not seem to be uncommon in the Luquillo Mountains.

Although *D. bidens* is a somewhat smaller plant than *D. hamatifolia*, the two species are closely related. In the latter species, however, the lobes of the leaves are shorter and less attenuate, and the antical margin is usually distinctly dentate, especially in the lower part. The leaf-cells are of about the same size in the two species but in *D. hamatifolia* the trigones are more conspicuous. The underleaves also offer good points of difference, the basal portion in *D. hamatifolia* being often bordered by more than six marginal cells and the widely spreading divisions measuring four or five cells in length and usually two cells in width at the base. In the European species, finally, the leaves are destitute of ocelli and the inflorescence is autoicous.

Among the Puerto Rico species *D. Araucariae* and *D. dissitifolia* are both close to *D. bidens*, as is also the species next described. Aside from the difference in size already noted *D. Araucariae* differs from *D. bidens* in its more distant leaves with more denticulate margins and in its more laciniate bracts and bracteoles. In *D. dissitifolia* also the leaves are more distant than in *D. bidens* and are distinguished further by being exocellate, but in this species the larger and more complicated underleaves offer the best differential characters.

Propagula are so abundantly produced in *D. bidens* that the microphyllous branches upon which they are borne deserve a few words of description. A branch of this character usually bears normal leaves at its base but as we proceed toward the apex we find the leaves gradually becoming smaller and arrested in their development. The aborted leaves are much shorter and narrower than normal leaves, their less attenuate lobes are suberect or obliquely spreading and are never falcate, their lobules are much reduced, in extreme cases consisting simply of a minute tooth borne near the postical base of the lobe. Nearly every one of these aborted leaves gives rise to a propagulum just behind it and as the propagula become detached very readily we can usually observe no signs of them except the basal sheaths which are left behind. The underleaves on the microphyllous branches are smaller than ordinary underleaves, their divisions being only one or two cells long. The propagula themselves are similar to those of *D. dissitifolia* and of other Puerto Rico species. It may be

noted here that *D. hamatifolia* also produces propagula which are specialized to only a slight extent ; the first underleaf for example although considerably larger than the succeeding one shows only a trace of a disc.

***Drepanolejeunea bispinulosa* sp. nov.**

Pale green, scattered among other hepatics : stems 0.035 mm. in diameter, prostrate, sparingly and irregularly pinnate, the branches widely spreading : leaves distant to subimbricated, the lobe obliquely spreading in lower part, widely spreading above, convex near base, plane or slightly concave beyond lobule, falcate-lanceolate, 0.35 mm. long, 0.1 mm. wide, slightly narrowed toward base and attached by an almost longitudinal line of insertion, margin distinctly crenulate or denticulate from projecting cells except near the base, the tooth near end of keel and the opposite tooth on antical margin larger than the others and spiniform, usually two or three cells long and one or two cells wide at the base, rarely obsolete, apex long-acuminate, ending in a row of three or four cells ; lobule strongly inflated throughout, ovate, 0.15 mm. long, 0.1 mm. wide, keel strongly arched, distinctly roughened in the outer part from projecting cells, free margin involute to or beyond the apex, then passing by a lunulate sinus to end of keel, apical tooth strongly curved ; cells of lobe slightly convex, the projecting wall slightly thickened, lateral walls variable, sometimes slightly and uniformly thickened, sometimes with small trigones, averaging  $17 \times 12 \mu$  ; ocelli indistinct, usually one in the middle of the lobe, sometimes obsolete : underleaves distant, similar to those of *D. bidens* : remaining parts unknown (*pl.* 4, *f.* 1-7).

On rotten wood. Luquillo Mountains, Heller (4743 *p.p.*).

*Drepanolejeunea bispinulosa* is very closely related to *D. bidens*, so closely in fact that it may be questioned whether it is really distinct or whether it represents a robust condition of that species. It differs from *D. bidens* in the more distinctly crenulate or denticulate margins of its lobes and especially in their two spiniform teeth. These slight differences give the plants an entirely different appearance from those of *D. bidens*, and so far no connecting links have been observed. Unfortunately the plants are entirely without sexual organs and do not even show propagula.

Almost equally close to *D. bispinulosa* is the Andine *Lejeunea* (*Drepano-Lej.*) *lichenicola* Spruce.\* The two species are of about

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\* Hep. Amaz. et And. 191. 1884.

the same size and agree in most of their leaf-characters. In *L. lichenicola* however no spiniform tooth is developed on the antical margin of the lobe. It differs from *D. bispinulosa* also in its underleaves which are characterized by their larger size and more widely spreading divisions, resembling to a certain extent the underleaves of *D. dissitifolia*.

***Drepanolejeunea crucianella* (Tayl.)**

*Lejeunea crucianella* Tayl. Lond. Jour. Bot. 5: 393. 1846.

*Lejeunea* (*Lepto-Lejeunea*) *crucianella* Spruce, Hep. Amaz. et And. 197. 1884.

Yellowish or brownish-green, growing in thin irregular patches, often in company with other *Lejeuneae*: stems 0.035 mm. in diameter, closely adherent to substratum, sparingly and irregularly pinnate, the branches widely spreading: leaves distant to contiguous, the lobe obliquely spreading, plane or slightly concave, the antical margin being more or less reflexed, ovate to ovate-lanceolate, 0.3 mm. long, 0.1 mm. wide, slightly narrowed toward base and attached by an almost longitudinal line of insertion, margin sharply and irregularly toothed beyond lobule, the first postical tooth and the opposite antical tooth larger than the others, spiniform, measuring three to five cells in length and one to three cells in width at the base, the succeeding teeth one to four in number on each side, sometimes obsolete, each consisting of one or two cells, apex attenuate, ending in a row of three or four cells, often curved forward; lobule strongly inflated at base and along keel, often plane and appressed to lobe along free margin, broadly ovate, 0.1 mm. long, 0.08 mm. wide, keel strongly arched, smooth or very slightly roughened in outer part from projecting cells, free margin passing beyond apex by a lunulate sinus to the terminal cell of the adnate portion of the lobule, apical tooth curved; cells of lobe plane or nearly so with slightly and irregularly thickened walls, averaging  $18 \times 14 \mu$ ; ocelli inconspicuous and sometimes obsolete, commonly two in each lobe, one near the base, the other near apex of lobule: underleaves distant, basal portion trapezoidal, 0.035 mm. long, marginal cells six, divisions widely spreading (up to 0.1 mm.), each consisting of two or three cells in a single row: inflorescence dioicous: ♀ inflorescence borne on a very short branch innovating on one side with a simple and sterile innovation; bracts obliquely spreading, unequally bifid, the lobe ovate, 0.25 mm. long, 0.13 mm. wide, margin irregularly spinose-dentate or ciliate, apex attenuate, lobule irregular in shape, 0.17 mm. long, 0.08 mm. wide, lacinate; bracteole connate on one side near base, oblong,

0.25 mm. long, 0.13 mm. wide, bifid about two fifths with acuminate and ciliate divisions and narrow sinus; perianth unknown: ♂ inflorescence terminal; bracts in two to five pairs, more or less imbricated, strongly inflated, shortly bifid, the lobe orbicular, abruptly apiculate or blunt at the apex, lobule blunt, keel roughened in outer part; antheridia in pairs (*pl. 4, f. 8-17*).

On living leaves. El Yunque, *Evans* (42 *p.p.*, 43 *p.p.*). Originally collected at Demerara and since found by *Spruce* in Brazil.

The type specimens of *Lejeunea crucianella* in the Taylor herbarium are very fragmentary and are also poorly developed. They agree very well, however, with some of the rudimentary specimens from Puerto Rico, and it seems justifiable to refer the latter to Taylor's species in spite of the unsatisfactory condition of the type. The specimens in the Lindenberg herbarium, preserved under the name *L. crucianella*, are, according to Stephani, a *Cololejeunea* and are referable to his *C. papilliloba*, a species known also from Brazil.\*

Apparently *D. crucianella* received its name on account of the peculiar form of the leaves when poorly developed. In these cases the spiniform teeth are almost as conspicuous as in well-developed leaves, while the apical portion of the lobe is scarcely longer than these spreading teeth and is entire or nearly so. This condition is seen especially well in ♂ material and is emphasized in *Spruce's* description. In well-developed leaves where the apical portion of the lobe is considerably longer than the spiniform teeth and is distinctly toothed on the margin, the specific name loses much of its significance. *Spruce* placed the species in *Lepto-Lejeunea*, probably on account of its diandrous bracts, but it is so close to several of the species described in the present paper that it ought hardly to be separated from them generically.

Among the Puerto Rico species *D. bispinulosa* is perhaps the most closely related to *D. crucianella*, the two species agreeing in the two spiniform teeth of their lobes. In the latter species, however, the teeth are longer and broader at the base and the portion of the lobe beyond the teeth is much more strongly toothed. The attenuate apex also, instead of spreading widely as in *D.*

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\* *Hedwigia*, 29: 73. 1890; 34: 250. 1895.

*bispinulosa*, is usually directed forward so that the long axis of the lobe is inwardly instead of outwardly curved. Of course the sharply toothed lobes would at once distinguish *D. crucianella* from *D. Araucariae* and from *D. dissitifolia*, two species which it resembles in habit, and also from *D. bidens*.

### **Drepanolejeunea infundibulata (Spruce)**

*Lejeunea (Drepano-Lejeunea) infundibulata* Spruce, Hep. Amaz. et And. 191. 1884.

Pale green, becoming brownish upon drying, growing in thin irregular patches: stems 0.04 mm. in diameter, closely adherent to substratum, irregularly pinnate, the branches obliquely to widely spreading: leaves distant, the lobe obliquely spreading, plane or with one or both margins slightly revolute near the apex, lanceolate, 0.5 mm. long, 0.15 mm. wide, straight or more or less falcate near apex, somewhat narrowed toward base and attached by an oblique line of insertion, margin entire or slightly denticulate from projecting cells, usually with a larger and sharper tooth composed of several cells near end of keel, apex acute to acuminate; lobule ovate, inflated in basal and carinal portions, usually plane and appressed to lobe along free margin, 0.15 mm. long, 0.09 mm. wide, keel arched, smooth or slightly roughened in outer part from projecting cells, free margin passing beyond apex by a lunulate sinus to end of keel, apical tooth strongly curved; lobule often poorly developed; cells of lobe thin-walled and without trigones, averaging  $17 \times 13 \mu$  at edge of lobe and  $23 \times 13 \mu$  in the middle; ocelli none: underleaves distant, basal portion broadly trapezoidal, 0.03 mm. long, marginal cells six, divisions widely spreading, sometimes as much as  $180^\circ$  and with a spread of 0.15 mm., each consisting usually of two cells in a row: inflorescence dioicous: ♀ inflorescence borne on a very short branch, innovating on one side with a simple and sterile innovation; bracts erect-spreading, scarcely complicate, unequally bifid, the lobe lanceolate, 0.4 mm. long, 0.12 mm. wide, acuminate, margin subentire or irregularly denticulate, lobule 0.25 mm. long, 0.07 mm. wide, acute to truncate, margin as in lobe; bracteole connate on one side, oblong-obovate, 0.35 mm. long, 0.14 mm. wide, bifid one fourth to one third with obtuse to acute lobes and acute sinus, margin as in bracts; perianth long-exserted, narrowly obovoid, 0.75 mm. long, 0.35 mm. wide in the middle, narrowed toward the base, truncate above and with a short beak, terete below, sharply five-keeled above, the keels extending outward and upward as acute, more or less spinose horns: ♂ inflorescence occupying a



short branch, bracts usually in three to ten pairs, closely imbricated, strongly inflated, shortly bifid, the lobe acute or obtuse, the lobule subacute, keel strongly arched, narrowly but distinctly winged in the upper part, the wing slightly denticulate from projecting cells; bracteoles present at base of spike, small, bifid with erect-spreading lobes and obtuse sinus; antheridia in pairs (*pl.* 5).

On living leaves. El Yunque, *Evans* (21 *p.p.*, 23 *p.p.*). Originally collected by *Spruce* on Chimborazo.

The type-specimens of *Lejeunea infundibulata* in the Spruce herbarium are exceedingly fragmentary and are badly mixed with *L. campanulata* Spruce, a closely allied species. They are at the same time so weather-worn that it is difficult to gain from them a clear idea of the species. Fortunately Spruce's description is definite and is apparently drawn from better specimens. The plants from Puerto Rico are in good condition and agree closely with the original description and also, so far as one can determine, with the battered type. A single discrepancy with regard to the keels of the perianth may be noted. According to Spruce these are "dilated into broad, acute, almost horizontal subula" and it is implied that they are smooth. In the writer's specimens the keels extend outward as slightly spinose horns. An examination of the type shows, however, that even here the keels are not invariably smooth but are sometimes more or less toothed, so that the species is apparently subject to considerable variation in this respect.

*D. infundibulata* is very closely related to the African *Lejeunea capulata* Tayl.\* but differs in its exocellate leaves. According to Spruce † *L. capulata* occurs in the Amazon region, but the specimens in the Spruce herbarium referred to this species, although very fragmentary, are evidently distinct from the type-material of *L. capulata* in the Taylor herbarium. They seem to be much closer to *D. bidens* or to *L. lichenicola*, but it would be unsafe to refer them definitely to either. At all events the evidence is very inadequate that *L. capulata* is a member of the American flora.

Other species more or less closely allied to *D. infundibulata* are *Lejeunea campanulata*, already mentioned, and the Puerto Rico species, *D. biocellata* and *D. dissitifolia*. *L. campanulata*

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\* Lond. Jour. Bot. 5: 394. 1846.

† Hep. Amaz. et And. 190. 1884.

differs in its ocellate leaves with distinctly denticulate margins and in its much shorter perianth with strongly spinose keels. *D. biocellata* differs in its smaller size, in its ocellate leaves, in its smaller leaf-cells with thicker walls and in lacking the sharp tooth near the end of the keel. *D. dissitifolia* finally is smaller than *D. infundibulata* and is distinguished further by its falcate leaves, by its more complicated underleaves and also by the absence of the sharp tooth.

Propagula are abundantly produced by *D. infundibulata* and are borne on microphyllous branches similar to those described for *D. bidens*. In extreme cases (*pl. 5, f. 3*) these branches are flagelliform and project at right angles from the substratum. The lobes of their leaves are broadly ovate or subrotund, the margin is quite entire and the apex varies from subacute to rounded. Oftentimes the terminal cell is apiculate. In many cases the reduced leaves are only four or five cells long. The lobules of these diminutive leaves consist of only three or four cells in a row, the terminal cell projecting as a minute tooth and the others being adnate to the lobe. The underleaves on the microphyllous axes develop no rhizoids and are frequently composed of only four cells, two forming the basal portion and the other two the minute and erect divisions.

DREPANOLEJEUNEA INCHOATA (Meissn.) Schiffn.

*Jungermannia inchoata* Meissn.; Lehmann, Pugillus, 5: 19. 1833.

*Lejeunea inchoata* Meissn.; G. L. & N. Syn. Hep. 343. 1845.

*Lejeunea epitheta* Tayl. Lond. Jour. Bot. 5: 395. 1846 (*teste* Stephani).\*

*Lejeunea* (*Drepano-Lejeunea*) *inchoata* Spruce, Hep. Amaz. et And. 187. 1884.

*Lejeunea* (*Drepano-Lejeunea*) *planiuscula* Spruce, l. c., 192. 1884 (*teste* Stephani).\*

*Drepanolejeunea inchoata* Schiffn.; Engler & Prantl, Nat. Pflanzenfam. 1<sup>3</sup>: 126. 1893.

Plants green, becoming brownish upon drying, growing in thin irregular patches: stems 0.06 mm. in diameter, closely adherent

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\* Hedwigia, 35: 83. 1896.

to substratum, irregularly pinnate, the branches widely spreading ; leaves (when well developed) loosely imbricated, the lobe obliquely spreading, plane or inflexed at the apex, falcate-ovate or falcate-rotund from a narrow base, 0.75 mm. long, 0.4 mm. wide, attached by a short, almost longitudinal line of insertion abruptly curving toward the middle of the axis in the upper part, antical margin more or less concave toward base, then strongly convex to apex, postical margin straight or slightly convex, apex acute, whole margin (except concave portion) coarsely and irregularly dentate, the teeth numerous especially along antical margin, often as many as twenty-five for the whole lobe, sharp, sometimes consisting of single projecting cells sometimes of small groups of cells, sinuses separating teeth lunulate ; lobule inflated in basal and carinal portions, usually plane and appressed to lobe along free margin, oblong-ovate, 0.25 mm. long, 0.14 mm. wide, keel slightly arched, smooth or nearly so, free margin almost straight as far as apex, then passing by a broad lunulate sinus to end of keel, apical tooth strongly curved ; leaves often poorly developed ; cells of lobe plane, with more or less confluent trigones and intermediate thickenings, averaging  $15\ \mu$  in diameter at edge of lobe,  $24\ \mu$  in the middle and  $46 \times 28\ \mu$  at the base ; ocellus single, often indistinct or obsolete, situated in the lower part of the lobe close to the apex of the lobule : underleaves distant, basal portion broadly trapezoidal, 0.05 mm. long, marginal cells six, divisions widely spreading (up to 0.25 mm.), usually three cells long and one or two cells wide at the base : inflorescence dioicous : ♀ inflorescence borne on a very short branch, innovating on one side with a simple or branched innovation ; bracts erect-spreading, scarcely complicate, unequally bifid, the lobe ovate, 0.4 mm. long, 0.2 mm. wide, acute or acuminate, margin irregularly dentate to subentire, lobule 0.3 mm. long, 0.08 mm. wide, acute or bidentate at the apex, margin as in lobe ; bracteole connate on one or both sides, linear to ovate, 0.4 mm. long 0.2 mm. wide, bifid about one third with lanceolate, acuminate lobes separated by a narrow sinus, margin as in bracts ; perianth about two thirds exserted, oblong-obovoid from a narrowed base, 0.6 mm. long, 0.3 mm. wide in the middle, truncate at the apex and with a very short or obsolete beak, terete below, sharply five-keeled above, the keels projecting outward as sharp, dentate to spinose horns, with usually one to four teeth or spines on each : ♂ inflorescence occupying a short branch ; bracts usually in three to eight pairs, closely imbricated, strongly inflated, shortly bifid with acute divisions, keel strongly arched with a narrow crenulate wing ; bracteoles present at base of spike, bifid with suberect divisions separated by a broad lunulate sinus (*pl. 6*).

On living leaves. First collected by *Schwanecke*. El Yunque, *Evans* (40, 41, 117). Type-locality, "in ins. Caraib. ad Filices." Now known from several of the West Indian islands, from Costa Rica and from various localities in South America.

*D. inchoata* may be at once distinguished from all the other Puerto Rico species of *Drepanolejeunea* by its large size and by its broad and coarsely dentate leaves, abruptly dilated from a narrow base. The description as given above is drawn mainly from robust specimens where the leaves attain their best development. On slender axes the leaves are smaller and narrower and their lobules are often inflated throughout; sometimes the lobules are rudimentary. These small-leaved branches must be distinguished from the flagelliform branches which bear the propagula. The latter are similar to those of *D. infundibulata* but their leaves are a little better developed. In his description of *L. planiuscula* Spruce calls attention briefly to these flagelliform branches but gives no hint as to their real significance. He also mentions "a form beset with a thick coating of adventitious ramuli, arising either from the leaves or (rarely) from the branches." They are said to "bear leaves reduced almost entirely to the basal sac, beyond which the lobe projects as a small triangular dentiform limb." These ramuli, which are apparently homologous with the propagula of *Plagiochila*, have not been observed in any of the Puerto Rico specimens.

So far as known the closest ally of *D. inchoata* is the paleo-tropic *D. setistipa* Steph., of Java, a species which was long confused with the American plant. The two species resemble each other very closely in their leaf-characters and differ mainly in their underleaves and perianths. The differences are well brought out by Stephani's description\* and by the somewhat earlier figures of Schiffner.† In *D. setistipa* the divisions of the underleaves are very divaricate, sometimes spreading at an angle of more than 180°; according to Schiffner's figures they measure six or seven cells in length and are two cells wide in the lower part. The basal portion of the underleaf is bounded by considerably more

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\* Hedwigia, 35: 83. 1896.

† Nova Acta Acad. Caes.-Leop. 60: p. 5. f. 5. 1893.

than six marginal cells. The perianth of *D. setistipa* is distinguished by its unarmed horns.

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### Explanation of Plates

As in the first paper of this series, the figures were drawn by the writer and prepared for publication by Miss Hyatt.

#### PLATE I

*Drepanolejeunea biocellata* Evans. 1. Part of stem, postical view,  $\times 70$ . 2. Part of stem, antical view,  $\times 70$ . 3. Cells from middle of lobe,  $\times 400$ . 4-6. Apices of lobes,  $\times 280$ . 7. Cells from margin of lobe,  $\times 280$ . 8. Apex of lobule,  $\times 280$ . 9. Underleaf,  $\times 280$ . The figures were all drawn from the type-specimens.

*Drepanolejeunea subulata* Steph. 10. Part of stem, postical view,  $\times 45$ . 11. Leaf, antical view,  $\times 45$ . 12. Cells from middle of lobe,  $\times 400$ . 13. Apex of lobe,  $\times 280$ . 14. Base of lobe,  $\times 280$ . 15. Apex of lobule,  $\times 280$ . 16. Underleaf,  $\times 280$ . 17, 18. Bracts,  $\times 70$ . 19. Bracteole,  $\times 70$ . The figures were all drawn from specimens collected by A. A. Heller (no. 4712).

#### PLATE 2

*Drepanolejeunea crassiretis* Evans. 1. Part of sterile stem, postical view,  $\times 75$ . 2. Part of stem, antical view,  $\times 75$ . 3. Leaf, flattened out,  $\times 75$ . 4. Cells from middle of lobe,  $\times 440$ . 5-7. Apices of lobes,  $\times 310$ . 8. Cells from margin of lobe,  $\times 310$ . 9. Apex of lobule,  $\times 310$ . 10. Underleaf,  $\times 310$ . 11, 12. Bracts,  $\times 75$ . 13. Bracteole,  $\times 75$ . The figures were all drawn from the type-specimens.

*Drepanolejeunea Araucariae* Steph. 14. Part of stem with ♀ inflorescence, postical view,  $\times 75$ . 15. Part of sterile stem, antical view,  $\times 75$ . 16. Part of stem with ♂ inflorescence, postical view,  $\times 75$ . 17. Cells from middle of lobe,  $\times 440$ . 18. Apical half of lobe,  $\times 310$ . 19. Apex of lobule,  $\times 310$ . 20. Underleaf,  $\times 310$ . 21, 22. Bracts,  $\times 75$ . 23. Bracteole,  $\times 75$ . The figures were all drawn from the specimens collected by the writer (no. 36).

#### PLATE 3

*Drepanolejeunea dissitifolia* Evans. 1. Part of plant, postical view,  $\times 70$ . 2. ♂ inflorescence, antical view,  $\times 70$ . 3. ♂ inflorescence, postical view,  $\times 70$ . 4. Cells from middle of lobe,  $\times 400$ . 5. Apex of lobe,  $\times 280$ . 6. Apex of lobule,  $\times 280$ . 7, 8. Underleaves,  $\times 280$ . The figures were all drawn from the type-specimens.

*Drepanolejeunea bidens* (Steph.) Evans. 9. Part of plant with ♀ inflorescence, postical view,  $\times 70$ . 10. Leaf, antical view,  $\times 70$ . 11. Cells from middle of lobe,  $\times 400$ . 12, 13. Apices of lobes,  $\times 280$ . 14. Apex of lobule,  $\times 280$ . 15. Underleaf,  $\times 280$ . 16. Bract with connate bracteole,  $\times 70$ . 17. Bract,  $\times 70$ . All the figures were drawn from specimens collected by A. A. Heller (no. 1139).

#### PLATE 4

*Drepanolejeunea bispinulosa* Evans. 1. Part of stem, postical view,  $\times 70$ . 2. Part of stem, antical view,  $\times 70$ . 3. Cells from middle of lobe,  $\times 400$ . 4. Apex of lobe,  $\times 280$ . 5. Cells and spiniform tooth from antical margin of lobe,  $\times 280$ . 6. Apex of lobule,  $\times 280$ . 7. Underleaf,  $\times 280$ . The figures were all drawn from the type-specimens.

*Drepanolejeunea crucianella* (Tayl.) Evans. 8. Part of plant with ♀ inflorescence, postical view,  $\times 70$ . 9. Branch with ♂ inflorescence, postical view,  $\times 70$ . 10. Part of stem, antical view,  $\times 70$ . 11. Cells from middle of lobe,  $\times 400$ . 12. Upper part of lobe,  $\times 280$ . 13. Apex of lobule, showing opening into water-sac,  $\times 280$ . 14. Apex of lobule,  $\times 280$ . 15. Underleaf,  $\times 280$ . 16. Bract,  $\times 70$ . 17. Bracteole,  $\times 70$ . All the figures were drawn from specimens collected by the writer (nos. 42, 43).

## PLATE 5

*Drepanolejeunea infundibulata* (Spruce) Evans. 1. Part of plant with perianth, postical view,  $\times 47$ . 2. Part of sterile stem, postical view,  $\times 47$ . 3. Flagelliform branch with two propagula,  $\times 72$ . 4. Leaf, antical view,  $\times 47$ . 5. Cells from middle of lobe,  $\times 425$ . 6. Tooth on postical margin,  $\times 300$ . 7. Apex of lobe,  $\times 300$ . 8. Apex of lobule,  $\times 300$ . 9. Underleaf,  $\times 300$ . 10. Bract and connate bracteole,  $\times 72$ . 11. Bract,  $\times 72$ . The figures were all drawn from specimens collected by the writer (no. 21).

## PLATE 6

*Drepanolejeunea inchoata* (Meissn.) Schiffn. 1. Part of stem with two perianths and a ♀ inflorescence, postical view,  $\times 44$ . 2. Part of sterile stem, postical view,  $\times 44$ . 3. Leaf, antical view,  $\times 44$ . 4. Cells from middle of lobe,  $\times 370$ . 5. Apex of lobe,  $\times 265$ . 6. Apex of lobule,  $\times 265$ . 7, 8. Underleaves,  $\times 265$ . 9, 10. Bracts with connate bracteoles,  $\times 65$ . The figures were all drawn from specimens collected by the writer (no. 41).